



New records and update on the geographic distribution of *Clitocybula lignicola* (Lj.N. Vassiljeva) E.F. Malysheva & O.V. Morozova (Basidiomycota: Agaricales) in Russia

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Abstract: *Clitocybula lignicola* is predominantly distributed in the Asian part of Russia. In Europe it was found only in the Urals (Komi Republic, Russia). Two new localities are situated in the northwestern part of Vologda Region (Russia). These are the first records of this species from the East European Plain, as well as the most western ones known in Europe. New records extend the geographic distribution of *C. lignicola* 1,204 km west of the closest site in the Urals. An updated distribution map for the species is presented and a detailed species description with illustrations based on studied collections is provided.

Key words: wood-inhabiting agaricoid fungi; riparian forest; East European Plain; Vologda Region; Europe

The genus *Clitocybula* (Singer) Singer ex Métrod (Marasmiaceae, Agaricales, Basidiomycota, Fungi) encompasses agarics with clitocyboid to collybioid fruitbodies mainly growing on wood. Species of *Clitocybula* are characterized by a radially fibrillose to squamulose (rarely granulose or glabrous to the naked eye) pileus surface, amyloid smooth spores, usually the presence of cheilo-, pileo- and caulocystidia and the absence of pleurocystidia and a cellular hypoderm (Bigelow 1973; Singer 1986; Barrasa et al. 2006; Antonín et al. 2011; Deepna Latha et al. 2015). Also, species with inamyloid spores are included in the genus *Clitocybula* by some researchers, e.g., *Clitocybula platyphylla* (Pers.) E. Ludw. [*Megacollybia platyphylla* (Pers.) Kotl. & Pouzar] (Ludwig 2001; Antonín et al. 2011). Three species have been reported from Russia: *C. abundans* (Peck) Singer (Bobretsova 2004; Ilyukhin 2009), *C. lacerata* (Scop.) Métrod (Lebedeva 1949; Beglyanova 1972; Vassiljeva 1973; Gorbunova 2001; Palamarchuk 2012), and *C. lignicola* (Lj.N. Vassiljeva) E.F. Malysheva & O.V. Morozova

(Vassiljeva 1973; Petrov 1981, 1991; Malysheva et al. 2011). *Clitocybula lignicola* is a red-listed fungus in some parts of Russia, i.e., Trans-Baikal Territory (Anonymous 2010), Buryatia Republic (Pronin 2013), and Irkutsk Region (Gaykova 2010).

Clitocybula lignicola was originally described as *Pseudoomphalina lignicola* Lj.N. Vassiljeva from the Russian Far East (Primorye Territory, Ussuriysk District, Suputinsky (= Ussuriysky) Reserve). The original description lacks information on some taxonomical characters, such as the presence and kind of cystidia (Vassiljeva 1973), that greatly complicated the species identification. Later a comprehensive description based on analyses of a neotype and numerous other specimens was proposed, and the taxon has been transferred to *Clitocybula* as a result of the morphological and phylogenetic analyses (Malysheva et al. 2011).

Clitocybula lignicola was distributed in the Western and Eastern Siberia and the Russian Far East (Malysheva et al. 2011). The species was recently found in Europe for the first time, on the West Sledy Ridge of the Ural Mountains (Yugyd Va National Park, Komi Republic) (Palamarchuk 2016). In the course of a revision of fungi collected in Vologda Region (in northwestern European Russia), several specimens were identified as *C. lignicola*. This paper presents the second record of the species in Europe (two new localities in Vologda Region) and expands this species' geographic distribution to the East European Plain.

The specimens were collected by the author in the period of 2004–2005 and in 2011 in two localities in the northwestern part of Vologda Region: Russky Sever National Park and Atleka Nature Reserve. In addition, one specimen was received from E.S. Popov collected in 2002 in Russky Sever National Park. The distance between two localities is 155 km. In Russky Sever National Park, new finds of *C. lignicola* are near Rusanovo



Figure 1. Appearance of *Clitocybula lignicola* (SVER 729000). **A.** Basidiomata. **B** and **C.** Pileus. Scale bars = 1 cm.

village (60°09' N, 038°33' E) and Kovarsino village (60°09'43.1" N, 038°35'49.1" E). The distance between these sites is about 2 km. Actually, both sites belong to the same unfragmented forest, and therefore, they are considered one locality. In Atleka Nature Reserve, specimens were collected from three sites (61°29'08.8" N, 037°41'44.7" E; 61°29'06.7" N, 037°41'55.1" E and 61°29' N, 037°41' E). The distances between sites are not greater than 100–200 m.

The specimens were identified by the author. The fungus, plant, and moss species names follow Malysheva et al. (2011), Tsvelev (2000), and Ignatov et al. (2006) respectively. The macroscopic description is based on the study of the fresh material. The microscopic features are described from examined material mounted in 5% KOH, Melzer's reagent and 1% Congo Red in concentrated NH_4OH . Measurements are based on observing

30 basidiospores, 10 cystidia and 10 basidia per collection. The quotient of length and width of the spores is reported as Q, and the arithmetic mean of the quotients is reported as Q^* . The specimens are kept at the Herbarium of the Institute of Plant and Animal Ecology (SVER). The distributional data of *C. lignicola* is based on published literature (Vassiljeva 1973; Anonymous 2010; Gaykova 2010; Malysheva et al. 2011; Petrov 1981, 2013; Pronin 2013; Palamarchuk 2016), and the author's own collections.

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Figures 1 and 2

Specimens examined: Russia: Vologda Region, Kirillov District, Russky Sever National Park, vicinity of Rusanovo village, herb-rich spruce forest, 60°09' N, 038°33' E, 16 August 2002 (SVER 729601);

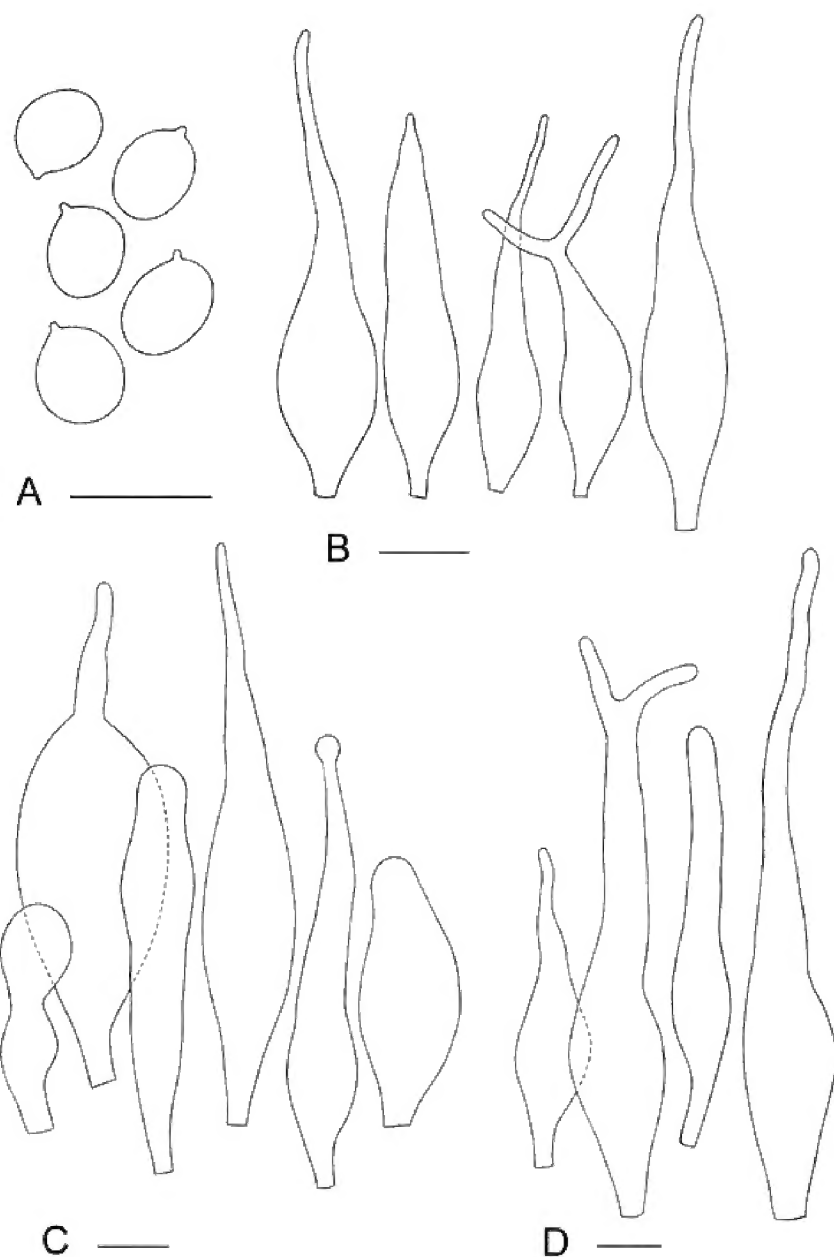


Figure 2. Details of the microstructure of *Clitocybula lignicola* (SVER 729000). **A.** Basidiospores. **B.** Cheilocystidia. **C.** Pileocystidia. **D.** Caulocystidia. Scale bars = 10 µm.

ibid., vicinity of Kovarsino village, fern spruce forest, on wood of spruce, 60°09'43.1" N, 038°35'49.1" E, 14 July 2004 (SVER 729602); ibid., 22 July 2005 (SVER 729603); Vytegra District, Atleka Nature Reserve, swampy spruce forest, on wood of spruce, 61°29'08.8" N, 037°41'44.7" E, 19 August 2011 (SVER 729604); ibid., herb-rich spruce forest, at the base of dead standing spruce, 61°29'06.7" N, 037°41'55.1" E, 19 August 2011 (SVER 729605); ibid., herb-rich spruce forest, on wood of spruce, 61°29' N, 037°41' E, 19 August 2011 (SVER 729000).

Basidiomata clitocyboid to omphalinoid. Pileus 7–40 mm, convex with depressed centre to funnel-shaped, with involute to straight margin, velvety to finely scaly, weakly hygrophanous. Margin slightly translucently striate or not, bright orange, fulvous, orange brown to brown. Lamellae deeply decurrent, distant, cream to yellowish. Stipe 53–75 mm long, 3–5 mm thick, cylindrical or slightly widened towards base, velvety to finely scaly, pale orange, yellowish brown, often paler towards top, at base usually distinctly tomentose-hairy. Smell indistinct.

Basidiospores broadly ellipsoid to subglobose 5.6–7.2 × 4.6–6.1 µm, $Q = 1.1$ –1.3, $Q^* = 1.2$, smooth, hyaline, strongly amyloid, thin-walled. Basidia 21.8–32.6 × 5.6–7.5 µm, clavate, with 4 or 2 sterigmata. Cheilocystidia 29.2–65.5 × 5.7–10.9 µm, forming sterile heteromorphic edge, fusiform to lageniform, sometimes branched. Pleurocystidia absent. Pileipellis a cutis. Pileocystidia

34.4–100.0 × 8.8–20.4 µm, abundant, variously shaped: cylindrical, fusiform, lageniform, clavate, sometimes branched. Caulocystidia 39.2–96.0 × 8.1–18.2 µm, variously shaped, mostly fusiform to lageniform, sometimes branched. Clamp connections numerous.

New records were found fruiting on dead wood of coniferous trees in riparian forests. According to the literature (Malysheva et al. 2011) species grows on dead wood or trunks of both deciduous and coniferous trees.

The distinguishing features of *C. lignicola* include a depressed or funnel-shaped, velvety to finely scaly orange pileus; deeply decurrent, creamy or yellowish lamellae; strongly amyloid broadly ellipsoid to subglobose basidiospores; the presence of cheilocystidia, pileocystidia, caulocystidia and a lignicolous habitat. This species is similar to *Clitocybula flavoaurantia* (Contu) E.F. Malysheva, O. Morozova & Contu in shape and color of basidiomata, basidiospore sizes and in the presence and shape of cheilocystidia, pileocystidia, and caulocystidia. *Clitocybula flavoaurantia* differs by having a glabrous pileal surface without fine scales, the structure of pileipellis with few scattered pileocystidia and by its occurrence on sandy soil in grasslands.

Clitocybula lignicola is only known from Russia (Figure 3). Most localities of *C. lignicola* are concentrated in Siberia and the Russian Far East (Malysheva et al. 2011). In European Russia this species has been recorded only from single locality in the Urals (West Sledy ridge, Yugyd Va National Park, Komi Republic) that is situated at the border between Europe and Asia (Palamarchuk 2016). New data presented here, show that geographic distribution of *C. lignicola* extends much further west, 1,204 km from the closest known site.

The new localities are the first records of this species from the East European Plain, as well as the most western ones known in Europe. Furthermore, the previous specimens were found mostly in and near mountain ranges, but the new sites are situated within moraine hills of glacial origin in the uplands of the East European Plain. The first locality (near Rusanovo and Kovarsino villages, Russky Sever National Park) is in the Belozersko-Kirillovskaya Upland. The absolute elevation is up to 210 m above sea level (a.s.l.). The second locality (Atleka Nature Reserve) is in the northeastern Andoma Upland that is a part of the East European Plain and is bordered on the northwestern by the Fennoscandia (Kulikov 2000). The absolute elevation is up to 298.8 m a.s.l.

Clitocybula lignicola occurs from the nemoral to the middle boreal vegetation subzones in the Asian part of Russia where it inhabits in coniferous (with dominated by *Picea* sp., *Abies sibirica* Ledeb., *Pinus sibirica* Du Tour, or *Larix sibirica* Ledeb.), floodplain deciduous (with *Alnus*, *Salix* and *Betula*), broad-leaved, and mixed forests. In the European part of Russia, the species is characterized by a more northerly distribution and occurs in the northern boreal (the Urals; Palamarchuk 2016) and the

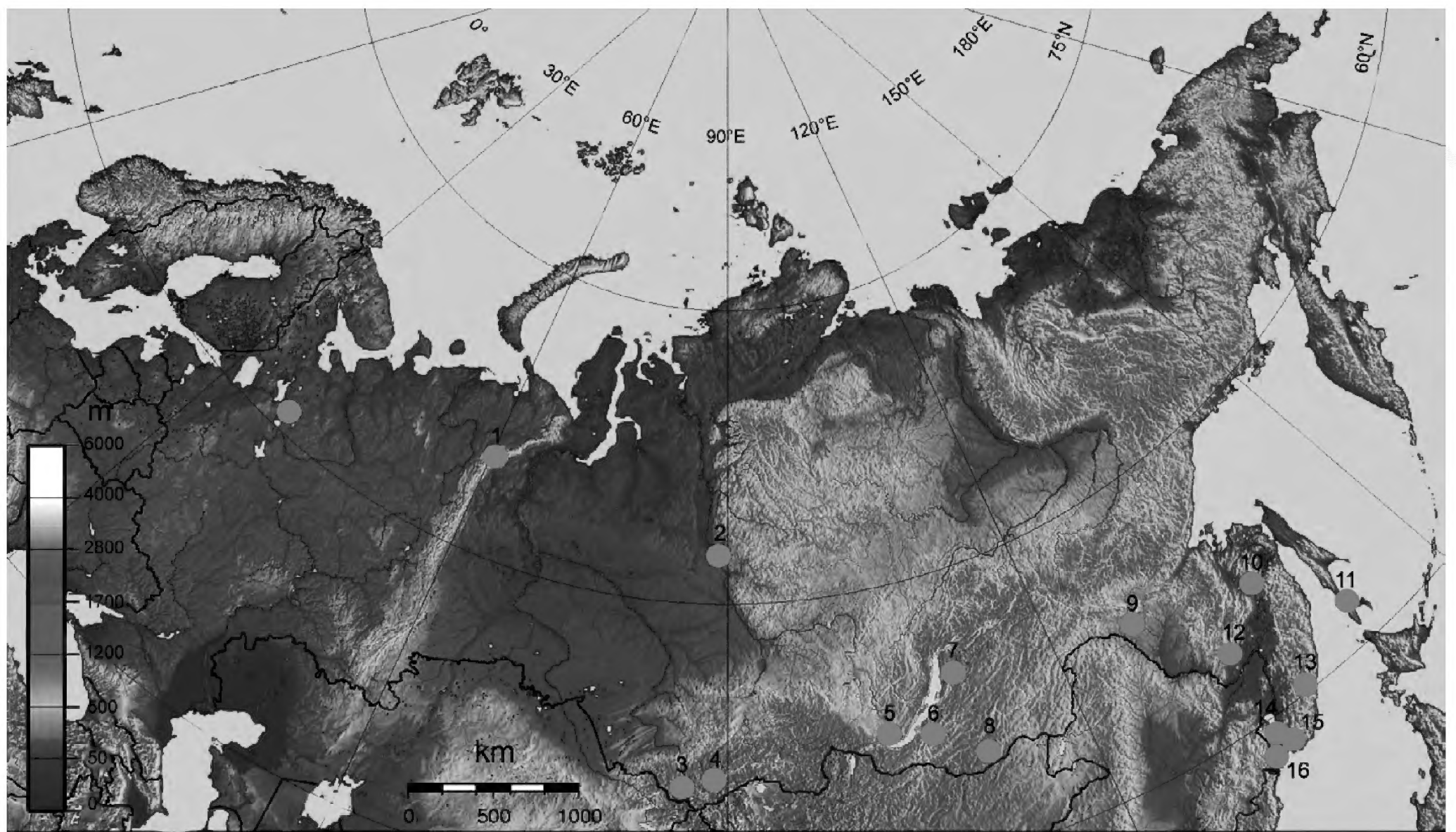


Figure 3. The distribution of *Clitocybula lignicola* in the Russian Federation. Red dot marks new records provided by this study; yellow dots indicate previous records. 1: Komi Republic, Yugyd Va National Park, West Sledy ridge. 2: Krasnoyarsk Territory: Turukhansk District, vicinities of Mirnoe. 3: Altai Republic, Ongudai District, the bank of the Bolshoy Ilgumen' River. 4: Altai Republic, Altai Nature Reserve, vicinities of Yaylyu, bank of the Atkichu River; ibid., bank of the Malyi Mionok River; ibid., bank of the Kamga River; Ulagan District, vicinities of Biyka. 5: Irkutsk Region, Pribaikalsky National Park, bank of Lake Baikal, vicinities of Listvennichnoye; ibid., vicinities of Bolshie koty; vicinities of Marituy; ibid., vicinities of Polovina. 6: Buryatia Republic, valley of the Selenga River, vicinities of Ilinka. 7: Buryatia Republic, Barguzin valley, vicinities of Garga. 8: Trans-Baikal Territory, Kyra District. 9: Amur Region, Tygda, bank of the Ulagan River. 10: Khabarovsk Territory, Komsomolsky Nature Reserve, basin of the Kamenka River. 11: Sakhalin Island, vicinities of Novo-Aleksandrovsk. 12: Jewish Autonomous Region, Bastak Nature Reserve, Sopka Dubovaya; ibid., valley of the Bastak River; ibid., headstream of the Ikura River. 13: Primorye Territory, Sikhote-Alin Nature Reserve, bank of the Tayezhnaya River. 14: Primorye Territory, Ussuriysky Nature Reserve, Sopka Grabovaya. 15: Primorye Territory, Shkotovo District, Khualaza Mountain; Lazovsky Nature Reserve, valley of the Perekatnaya River. 16: Primorye Territory, Muravyov-Amursky Peninsula, basin of the Bogataya River, Sopka Koreiskaya; vicinities of Vladivostok, Emar bay; vicinities of Vladivostok, Bogataja Griva; Kedrovaya Pad Nature Reserve, valley of the Kedrovaya River.

middle boreal (the East European Plain, new records) vegetation subzones. In the Ural Mountains, *C. lignicola* was found in the forest with dominated by *Abies sibirica* and *Picea obovata* Ledeb. (Palamarchuk 2016). In the western part of Vologda Region, where the new localities are situated, the spruce forest stand is formed by *Picea abies* (L.) Karst., *P. obovata*, and their hybrid forms (Afanasyeva 2010; Czhobadze et al. 2014).

The new records are reported in riparian habitats such as herb-rich spruce forests located in well-drained moist and swampy places, probably linked with the microclimatic moisture conditions.

In the area near Rusanovo village, *C. lignicola* was found in a spruce forest with a herb layer dominated by *Aconitum lycoctonum* L. and *Oxalis acetosella* L. The other site, near Kovarsino village, is a spruce forest along an ephemeral stream and is characterized by a herbaceous layer dominated by ferns, i.e., *Dryopteris expansa* (C. Presl) Fras.-Jenk. et Jermy, *Gymnocarpium dryopteris* (L.) Newm., and *Phegopteris connectilis* (Michx.) Watt,

and such herbs as *Oxalis acetosella*, *Stellaria longifolia* Muehl. ex Willd., and *Majanthemum bifolium* (L.) F.W. Schidt. The forest stand is about 90 years old. In Atleka Nature Reserve, the three studied sites are old-growth spruce-dominated forest without traces of past logging. The forest stand is about 200 years old. The first site is at the foot of moraine hills along the Bely stream. It is a swampy forest with a herb layer of *Carex* spp., *Equisetum silvaticum* L., *Menyanthes trifoliata* L., *Rubus chamaemorus* L., *Chamaedaphne calyculata* (L.) Moench, etc. The ground-dwelling moss synusia are formed by *Sphagnum* spp. and *Polytrichum commune* Hedv. Two other sites are situated within lower part of the slope on moist well-drained soil. The main components of the herb layer in these sites are *Aconitum lycoctonum* and *Equisetum silvaticum*.

There is also some information about the occurrence of *C. lignicola* along streams, in regularly flooded alluvial sites, and along shores (Malysheva et al. 2011; Petrov 2013; Palamarchuk 2016).

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